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Heater clamp arrangement

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- US5411392 (A1)
- JP7195438 (A)
- EP0653283 (A3)
- EP0653283 (B1)

Cited documents:

- EP0444748
- US4968247
- US4859176
- EP0590621
- US5267375

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Abstract of **EP0653283**

An improved heater clamp arrangement for use in molding including channel means for transferring molten plastic, a sheet-like band heater (50) around at least a portion of the channel means for heating the channel means and molten plastic, and means (56) placing continuous pressure on the band heater to urge same towards the channel means in the hot and cold condition, as a sheet-like strip.

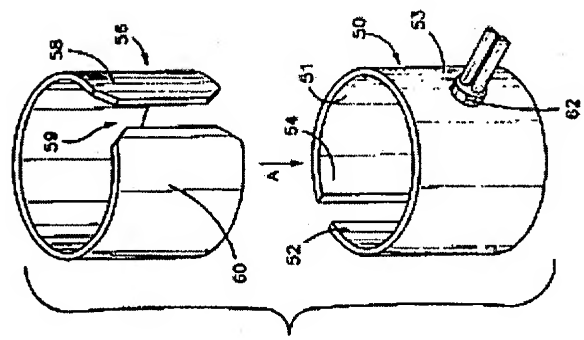

FIG-2

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(54) **Heater clamp arrangement**

Spannanordnung für Heizelement

Dispositif de serrage pour élément de chauffage

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EP 0 653 283 B1

Description

BACKGROUND OF THE INVENTION

The present invention relates to a heated assembly according to the prior art portion of claim 1. Such an arrangement is used in an injection molding machine, especially in an injection molding machine of the hot runner type, particularly useful in securing a heater element in a desired position around a nozzle body for feeding liquified plastic to an injection gate of a mold cavity.

To maintain the fluidity of the resident plastic material during closure of the injection gate, enabling its use in a following molding cycle, it is desirable to form a terminal part of the sprue channel as an axial bore of a nozzle of good thermal conductivity closely surrounded by an electrical heating element. Some nozzle manufacturers go through costly processes to integrate heaters into the nozzle body. The primary disadvantage with this approach however is that should the heater get damaged the nozzle is lost as well. Thus, it is preferred that the heating element be removably mounted onto the nozzle body for ready replacement. One of the primary challenges associated with this technique is holding the heating element firmly against the external surface of the hot runner nozzle housing so as to maximize heater performance.

To obtain effective and efficient heat transfer from the heater to the heated part, it is necessary to have close contact between them. This is generally accomplished by use of a clamping device such as a metal shroud which encompasses the heater body and is screwed together at its ends to draw the heater tighter against the nozzle to be heated. This method has an advantage of being simple, using common tools such as a screw driver to tighten or loosen the heater. However, in cases where the heater must be installed in a confined area it can be difficult to access the screw head for tightening purposes once it is in its correct orientation in the molding machine. Typically, the obstruction is the mold plate adjacent to and surrounding the heater. In such cases, additional clearance is often machined into the plate to permit the tightening tool to reach the screw head.

In situations where it is prohibitive to add clearance machining because it will compromise the strength of the mold plate or reduce the plate material available to back-up and support other mold components, a design as shown in U.S. Patent No. 4,968,247, issued November 6, 1990, permits tightening of the heater by way of a cam actuated clamp housing. This design permits a tool to approach from the axial direction of the heater, thus requiring no special clearance for the tightening tool. While this is an improvement for ease of assembly and structural integrity of the mold plate, there is still the need to cut a small pocket of clearance for the cam mechanism which stands outside of the cylindrical profile of the outer surface of the heater. Likewise there is a variety of other tightening devices available for use on the market, which also invariably add substantially to the outer diameter of the heater.

Some coil heaters on the market have no external clamping mechanism but use the spring nature of the coil to hold its position on the nozzle. By design, the element must be heavy (thick) and stiff, to maintain its size, shape and gripping ability. Thus, it can be difficult to install or remove in a confined space or without special tools.

Clampless heaters show no clamp mechanism at all, but instead rely on an extremely precise fit between the heater and the nozzle, thus requiring no extra clearance other than for the outer diameter of the heater. Aside from the high cost of manufacturing both fitting diameters, there are additional drawbacks, for example, it can become necessary to engineer additional devices to trap the heater on the nozzle to prevent it from slipping axially away from its installed position during handling or movement of the mold. These heaters also tend to have a thick wall section, in the order of 4 mm for heaters with a 12-42 mm internal diameter. Also, should any burrs or surface imperfections exist on the mating surfaces the heater can seize on the nozzle and become very difficult to remove without damage to the heater or the nozzle.

An assembly of the type indicated in the preamble of claim 1 is disclosed in EP-A-0 444 748. The heater is urged towards the channel means by a clamping sleeve. The outer peripheral fase of the heater is tapered. The clamping sleeve having an inner tapered peripheral face is slid over the heater. The wedging effect between the tapered surfaces causes the heater to be clamped around the channel means.

It would be highly desirable to provide a simple, cost effective way to clamp a heater to an injection molding nozzle or other channel means for transferring molten plastic while increasing the outer diameter of the channel means as little as possible. Accordingly, this is the principal objective of the present invention.

A further object of the present invention is to provide an improved heater clamp arrangement as aforesaid which is easy and convenient to use in a confined area with little space and which is operative to clamp the heater to the channel means in the hot or cold condition.

Further objects and advantages of the present invention will appear hereinbelow.

SUMMARY OF THE INVENTION

In accordance with the present invention, the foregoing objects and advantages are readily obtained.

The heated assembly of the present invention is characterized by the features of claim 1.

Preferred embodiments of the heated assembly of the present invention are subject of dependent claims.

In the preferred embodiment, the channel means is

an injection molding nozzle, but other components of the injection molding machine may be used wherever a channel means is desired to transfer molten plastic, as the hot runner channel or transfer channels.

The heater has an outside surface and an inside surface. Preferably the sheet-like strip engages the outside surface, surrounds at least a portion thereof and places the heater under continuous tension and presses the heater towards the channel means. The channel means is a generally cylindrical member with an outside diameter, with the heater and sheet-like strip also being generally cylindrical members which at least partly surround the outside diameter of the channel means.

The sheet-like strip is preferably a metal strip from 0.1 - 4 mm. thick, made from high carbon spring steel.

The heater includes leads extending therefrom and the sheet-like strip includes a gap wherein the leads extend through the gap.

The sheet-like strip should have a diameter smaller than the diameter of the heater and preferably surrounds the heater to place the heater under continuous tension.
However, in an alternate embodiment, the sheet-like strip may be secured to the inside diameter of the heater, as by welding, and thereby place the heater under tension to pull same towards the channel means.

The nozzle is generally positioned in at least one plate, as in a mold plate and/or backing plate, and spaced therefrom, with the heater and sheet-like strip positioned in the space between the nozzle and plate. The instant invention provides a simple, cost effective way to clamp the heater to the channel means, while increasing the outside diameter of the channel as little as possible. The design preferably comprises a low profile mica band with spring-like characteristics that practically covers the entire outer surface of the heater. Sliding the heater onto a nozzle by hand or with conventional snap-ring pliers is simple as there are no coils to get hung up or unraveled. A further advantage over a coil heater is the inherent unheated area at the split of the heater band. In nozzles where an eccentrically located melt channel is employed, it can be positioned directly over a melt channel in the nozzle, preventing local overheating of the plastic melt. The spring-clip has been determined to be effective at only a fraction of the heater wall thickness, resulting in a very compact overall assembly. The heater can easily be installed and removed any number of times with no concern of damage and the manufacturing tolerances of the fitting diameters is substantially more liberal. A further advantage of the instant invention is that mold plate machining time is minimized, as a simple rough bored hole is all that is required to provide ample clearance.

Further objects and advantages of the present invention will appear hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more readily understandable from the following illustrative drawings in which:

Figure 1 is a cross-section view of an arrangement according to the present invention with portions cut away;

Figure 2 is a side view of the band heater and sheet-like strip separated from each other;

Figures 3A and 3B are top views of the band heater and sheet-like strip assembled together;

Figure 4 is a perspective view of the hot runner and nozzle channels with assembled heater arrangements separated from other mold components; and

Figures 5A, 5B and 6 are alternate embodiments of the means for placing continuous pressure on the heater.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the figures, Figure 1 illustrates part of a hot runner structure 10 serving to supply liquified thermoplastic resin from a pressure chamber (not shown) via a hot runner 12 including a hot runner channel 14 to transfer channel 16 to an injection gate 18 of a mold plate 20. The gate 18 is alternately opened and closed by a rod or pin 22 connected to a double-acting piston (not shown). The piston for operating the rod or pin does not form part of the present invention and may be any suitable piston known in the art for actuating such a valve rod. Alternatively, the gate may not use a rod but rather rely on thermal separation for the opening and closing thereof.

A cooled intermediate or backing plate 24 is inserted between the mold plate 20 and the hot runner 12. The backing plate 24 supports a nozzle 26 provided with an annular skirt 28 surrounding a tubular nozzle body 30. The nozzle 26 including the skirt portion 28 and the nozzle body portion 30 is formed from a material having good thermal conductivity. The tubular nozzle body 30 forms part of the hot runner system for supplying liquified plastic material to the injection gate 18. A nozzle tip 32 formed from a highly heat-conductive material, such as beryllium/copper, is seated in the nozzle body 30 and extends into the mold plate 20 as a guide for the free end of the valve rod 22.
An annular space existing between the end of the nozzle body 30, the tip 32 and the mold plate 20 is occupied by a sheath 34 of resinous material. This sheath may be prefabricated or may be formed from the overflow of injected resin in the first operating cycle or cycles. The sheath 34 serves primarily as a thermal insulator.

As shown in Figure 1, the tubular body 30 has an axial channel 36 or upper nozzle channel which forms part of the transfer channel 16 from hot runner channel

14 into gate 18 through which molten plastic material is conveyed from the source (not shown) to the gate 18. The tip 32 also has a channel 38 or lower nozzle channel that forms part of the transfer channel 16 for conveying the molten plastic material to the gate 18.

When the gate 18 is closed by the rod 22, molten plastic material will reside in the channels 36 and 38. To keep this plastic material in a liquified state, a heater 40 is provided around a portion of the nozzle body 30. The heater 40 is positioned within a space 41 defined by the skirt 28, the backing plate 24 and the nozzle body 30 and is in contact with the outer surface 42 of the nozzle body 30. An electrical cable 44 passes through a passageway in the backing plate and is connected to the heater 40 so that electrical power may be provided thereto.

In addition, in order to keep the plastic in a liquified state in the hot runner channel or in other channel means running from the pressure chamber, heaters 46 may be provided around hot runner channel 14 as shown in Figure 1, with heaters 46 substantially the same construction as heaters 40.

The heater 40 or 46 is a sheet-like band heater 50 as shown in Figure 2 which is formed into the desired shape, as the annular configuration shown, depending on the shape of the channel means. The annular shaped heater 50 has an inside surface 51 and an outside surface 53. Preferably ends 52 and 54 thereof are spaced apart to leave an open space therebetween to permit compression thereof by the sheet-like strip 56, placed over heater 50 in the direction of arrow A to engage the outside surface 53 of heater 50 and/or to provide an unheated portion which may be desirable in some applications. The heater 50 should be substantially planar, as a mica heater, and is preferred to be relatively thin and compliant under the spring-clip pressure of strip 56 to insure good contact with the heated part. However, foil-type heaters may also be used. Thus, the heater may have a thickness of 0.1 - 20 mm. and preferably 2 - 4 mm.

Spring 56 may be made from any suitable sheet metal material which exhibits spring-like characteristics, i.e., which places continuous pressure on the adjacent heater to urge same towards the channel means in the hot or cold condition. High carbon spring steel in sheet metal form is particularly suitable. It is cut to a suitable shape as shown in Figure 2 and is then formed into a circular shape using a forming tool and it can be hardened and tempered afterwards. Hardness in the range of 42-46 Rockwell C is preferred. The heater is generally thicker than the sheet-like strip, with the sheet-like strip having a thickness range of 0.1 - 4 mm. and generally 0.2 - 1 mm., although of course this can be varied to suit the strength of spring required for the heater. Naturally, alternative materials can be used to aid corrosion protection, fatigue strength, extreme heat, etc., as needed for the specific application. The sheet-like strip or clip exhibits continuous pressure on the heater and may continuously contact the heater along the entire surface thereof. However, other configurations may be used, as the clip may completely surround the heater and overlap itself. Also, as shown in Figure 2, ends 58 and 60 of clip 56 may be spaced from each other to leave a gap 59 therebetween which permits wire or lead 62 from heater 50 to exit as shown in Figure 3A. Naturally, the spring-like clip 56 is preferably formed into a diameter smaller than heater 50 so as to exert continuous tension therearound and to apply a preload to the heater for a secure assembly.

Figure 3A shows the assembled unit 64 with clip 56 surrounding heater 50. Alternatively, clip 56 may be affixed to the inside surface 51 of heater 50 as shown in the assembled unit 66 in the embodiment of Figure 3B, as by welding or forming tabs which grip the heater to pull same inwards towards the channel means.

The heater-clamp arrangement of the present invention may effectively be employed on any channel means from a source of molten plastic to the injection gate. Thus, as shown in Figure 4, heating clamp unit 64 may be placed around injection nozzle 70 or hot runner channel 72. If convenient, a plurality of shorter pieces of the heater-clamp arrangement may be used, or a longer assembly. In addition a single heater unit may have a plurality of clips affixed thereto.

The means placing continuous pressure on the heater may be a bar or rod, such as bar 80 shown in Figure 5A or rod 81 shown in Figure 5B. These may be used as in the previous embodiments, as simply wrapped around the heater in a manner after Figure 3A. Alternatively, one may form the sheet-like strip with ribs 85 on strip 86 shown in Figure 6 to provide additional rigidity to the sheet-like strip.

As a further alternative, one may construct the heater of material providing spring-like characteristics to operate to place continuous pressure on the heater without a separate clip-like component and to urge same towards the channel means, i.e., the improved heater-clamp arrangement of the present invention may be a monolithic spring-like heater made of, for example, high carbon spring steel with the spring steel construction continuously urging the heater towards the channel means.

As a further alternative, the spring-like material may be laminated to the heater as the inside or outside diameter thereof, as in the form of a composite laminate.

Thus, the assembly of the present invention is easy to install, has a low profile enabling more compact design possibilities, involves less mold plate machining, has stronger mold plate and support capabilities, a possible unheated portion, and represents a low cost heater clamp device with efficient heat exchange capabilities.

It is to be understood that the invention is not limited to the illustrations described and shown herein, which are deemed to be merely illustrative of the best modes of carrying out the invention, and which are susceptible

of modification of form, size, arrangement of parts and details of operation. The invention rather is intended to encompass all such modifications which are within its scope as defined by the claims.

Claims

1. A heated assembly for use in plastic molding, including: a channel means (14,72) or nozzle assembly (26,70) for transferring molten plastic; an electrically activated band heater (50) having an outside diameter around at least a portion of said channel means (14,72) or nozzle assembly (26,70) for heating said channel means or nozzle assembly and molten plastic, and including means placing continuous pressure on said heater (50) to urge said heater towards said channel means or nozzle assembly,
   characterised in that
   said continuous pressure means (56,86,60,80,81) comprised of a material which exhibits spring-like characteristics to urge said heater (50) towards said channel means or nozzle assembly when the heater is electrically activated or deactivated.

2. Assembly according to claim 1, wherein said heated assembly is a nozzle assembly (26,70) and wherein the continuous pressure means is in the form of a separate sheet-like material strip (56,86), a bar (80) or a rod (81) adjacent said heater (50) and wherein the continuous pressure means is formed with a diameter less than the outside diameter of said heater and such that said continuous pressure means places continuous pressure on said heater.

3. Assembly according to claim 1 or 2 wherein the continuous pressure means is at least one of the outside (53) and inside wall (51) of the heater (50).

4. Assembly according to one of the claims 1 to 3 wherein the continuous pressure means includes strengthening ribs (85).

5. Assembly according to one of the claims 1 to 4 wherein said channel means is at least one of an injection nozzle (70) and a hot runner channel (72).

6. Assembly according to one of the claims 1 to 5, wherein the heater (50) has an inside surface (51) and an outside surface (53), wherein the continuous pressure means engages the outside surface, surrounds at least a portion thereof, places the heater under continuous tension and presses the heater towards the channel means, said heater and continuous pressure means preferably having an annular shape.

7. Assembly according to one of the claims 1 to 6 wherein said continuous pressure means being a metal spring clip (56), preferably of high carbon steel.

8. Assembly according to claim 7 wherein said clip (56) is 0.1 - 4 mm thick and said heater is 0.1 - 20 mm thick, and the heater (50) is thicker than the clip (56).

9. Assembly according to claim 7 or 8 wherein the heater (50) includes leads (62) extending therefrom and the continuous pressure means (56) includes end portions (58,60) spaced from each other to form a gap (59) with the leads extending through the gap.

10. Assembly according to one of the claims 1 to 9 wherein the heater (50) has an inside surface (51) and an outside surface (53), and wherein the continuous pressure means (56) engages the inside surface and is secured thereto and places the heater under tension to pull same towards the channel means.

11. Assembly according to one of the claims 1 to 10 wherein the heater (50) has end surfaces (52,54) spaced apart to leave an open space therebetween to permit compression of said end surfaces by said continuous pressure means.

Patentansprüche

1. Geheizte Anordnung zur Verwendung beim Giessen von Kunststoff, umfassend: ein Kanalmittel (14,72) oder eine Düsenanordnung (26,70) zur Überführung von geschmolzenem Kunststoff; ein elektrisch aktiviertes Bandheizelement (50) mit einem äusseren Durchmesser, der zumindest einen Teil jenes Kanalmittels (14,72) oder jener Düsenanordnung (26,70) zum Heizen jenes Kanalmittels oder jener Düsenanordnung und des geschmolzenen Kunststoffes umschlingt, und einschliesslich Mittel zur Ausübung eines kontinuierlichen Druckes auf jenes Heizelement (50), um jenes Heizelement gegen jenes Kanalmittel oder jene Düsenanordnung zu drängen,
   dadurch gekennzeichnet, dass
   jenes Mittel (56,86,60,80,81) zur Ausübung des kontinuierlichen Druckes ein Material umfasst, welches federartige Eigenschaften aufweist, um jenes Heizelement (50) gegen jenes Kanalmittel oder jene Düsenanordnung zu drängen, wenn das Heizelement elektrisch aktiviert oder deaktiviert ist.

2. Anordnung nach Anspruch 1, dadurch gekennzeichnet, dass jene geheizte Anordnung eine Düsenanordnung (26,70) ist und wobei das Mittel

zur Ausübung eines kontinuierlichen Druckes die Form eines separaten blattförmigen Materialstreifens (56,86) eines Balkens (80) oder einer zu jenem Heizelement (50) benachbarten Stange (81) aufweist und wobei das Mittel zur Ausübung des kontinuierlichen Druckes mit einem Durchmesser kleiner als der äussere Durchmesser jenes Heizelementes ausgebildet ist und dass jenes Mittel zur Ausübung des kontinuierlichen Druckes kontinuierlichen Druck auf jenes Heizelement ausübt.

3. Anordnung nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass das Mittel zur Ausübung des kontinuierlichen Druckes die aussenseitige (53) oder die innenseitige Wand (51) des Heizelementes (50) bildet.

4. Anordnung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass das Mittel zur Ausübung des kontinuierlichen Druckes Verstärkungsrippen (85) umfasst.

5. Anordnung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, dass jenes Kanalmittel eine Einspritzdüse (70) oder ein Heisskanal (72) ist.

6. Anordnung nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, dass das Heizelement (50) eine innere Oberfläche (51) und eine äussere Oberfläche (53) aufweist, wobei das Mittel zur Ausübung des kontinuierlichen Druckes mit der äusseren Oberfläche in Eingriff steht, zumindest einen Teil davon umschlingt, das Heizelement unter kontinuierliche Spannung setzt und das Heizelement gegen das Kanalmittel drückt, wobei jenes Heizelement und das Mittel zur Ausübung eines kontinuierlichen Druckes vorzugsweise eine ringförmige Gestalt aufweisen.

7. Anordnung nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, dass jenes Mittel zur Ausübung des kontinuierlichen Druckes eine Metallfeder (56) ist, vorzugsweise aus hoch kunststoffhaltigem Stahl.

8. Anordnung nach Anspruch 7, dadurch gekennzeichnet, dass jene Klammer (56) 0,1 - 4 mm und jene Heizvorrichtung 0,1 - 20 mm dick ist, und das Heizelement (50) dicker als die Klammer (56) ist.

9. Anordnung nach Anspruch 7 oder 8, dadurch gekennzeichnet, dass das Heizelement (50) von diesem ausgehende Anschlüsse (62) umfasst und das Mittel (56) zur Ausübung des kontinuierlichen Druckes Endteile (58,60) einschliesst, die unter Bildung eines Spaltes (59) voneinander beabstandet sind, wobei die Anschlüsse sich durch den Spalt erstrecken.

10. Anordnung nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, dass das Heizelement (50) eine innere Oberfläche (51) und eine äussere Oberfläche (53) aufweist, und wobei das Mittel (56) zur Ausübung des kontinuierlichen Druckes mit der inneren Oberfläche in Eingriff steht und an dieser befestigt ist und das Heizelement unter Spannung setzt, um dieses gegen das Kanalmittel zu ziehen.

11. Vorrichtung nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, dass das Heizelement (50) Endoberflächen (52,54) aufweist, die voneinander beabstandet sind und einen offenen Freiraum begrenzen, um eine Kompression jener Endoberfläche durch jenes Mittel zur Ausübung des kontinuierlichen Druckes zu ermöglichen.

Revendications

1. Ensemble chauffé à utiliser pour le moulage de matières plastiques, incluant : un moyen de canal (14,72) ou un ensemble (26, 70) de tuyère pour transférer une matière plastique fondue ; un élément chauffant (50) en forme de bande alimenté électriquement dont un diamètre extérieur est agencé autour d'au moins une partie dudit moyen de canal (14,72) ou ensemble (26, 70) de tuyère pour chauffer ledit moyen de canal ou ledit ensemble de tuyère, et incluant un moyen d'application d'une pression continue sur ledit élément chauffant (50) pour solliciter ledit élément chauffant vers ledit moyen de canal ou ledit ensemble de tuyère, caractérisé en ce que

   ledit moyen de pression continue (56, 86, 60, 80, 81) est en une matière qui présente des caractéristiques de type élastique, pour solliciter ledit élément chauffant (50) vers ledit moyen de canal ou ledit ensemble de tuyères lorsque l'élément chauffant est activé ou désactivé électriquement.

2. Ensemble selon la revendication 1, dans lequel ledit ensemble chauffé est un ensemble (26, 70) de tuyère et dans lequel le moyen de pression continue est en forme de languette séparée (56, 86) du type feuille, de barre (80) ou de tige (81) adjacente audit élément chauffant (50) et dans lequel le moyen de pression continue est d'un diamètre inférieur au diamètre extérieur dudit élément chauffant et est tel que ledit moyen de pression continue exerce une pression continue sur ledit élément chauffant.

3. Ensemble selon la revendication 1 ou 2 dans lequel ledit moyen de pression continue est au moins, soit la paroi extérieure (53), soit la paroi intérieure (51) de l'élément chauffant (50).

4. Ensemble selon l'une des revendications 1 à 3 dans lequel le moyen de pression continue inclut des nervures de renforcement.

5. Ensemble selon l'une des revendications 1 à 4 dans lequel ledit moyen de canal est au moins, soit une tuyère d'injection (70), soit un canal (72) de buse chaude.

6. Ensemble selon l'une des revendications 1 à 5, dans lequel l'élément chauffant (50) comporte une surface intérieure (51) et une surface extérieure (53), dans lequel le moyen de pression continue est au contact de la surface extérieure, entoure au moins une partie de celle-ci, place l'élément chauffant sous tension continue et appuie l'élément chauffant vers le moyen de canal, la configuration dudit élément chauffant et dudit moyen de pression continue étant de préférence annulaire.

7. Ensemble selon l'une des revendications 1 à 6 dans lequel ledit moyen de pression continue est une pince élastique métallique (56), de préférence en acier à haut carbone.

8. Ensemble selon la revendication 7 dans lequel l'épaisseur de ladite pince (56) est de 0,1 à 4 mm et l'épaisseur dudit élément chauffant est de 0,1 à 20 mm, et l'élément chauffant (50) est plus épais que la pince (56).

9. Ensemble selon la revendication 7 ou 8 dans lequel l'élément chauffant (50) inclut des conducteurs (62) qui s'étendent à partir de ce dernier et le moyen de pression continue (56) inclut des parties d'extrémités (58, 60) espacées l'une de l'autre de manière à former un intervalle (59), les conducteurs s `étendant à travers l'intervalle.

10. Ensemble selon l'une des revendications 1 à 9 dans lequel l'élément chauffant (50) comporte une surface intérieure (51) et une surface extérieure (53), et dans lequel le moyen de pression continue (56) est au contact de la surface intérieure et y est fixé, et place l'élément chauffant sous tension afin de le tirer vers le moyen de canal.

11. Ensemble selon l'une des revendications 1 à 10 dans lequel l'élément chauffant (50) comporte des surfaces d'extrémités (52, 54) espacées l'une de l'autre pour laisser entre elles un espace ouvert afin de permettre la compression desdites surfaces d'extrémités par ledit moyen de pression continue.

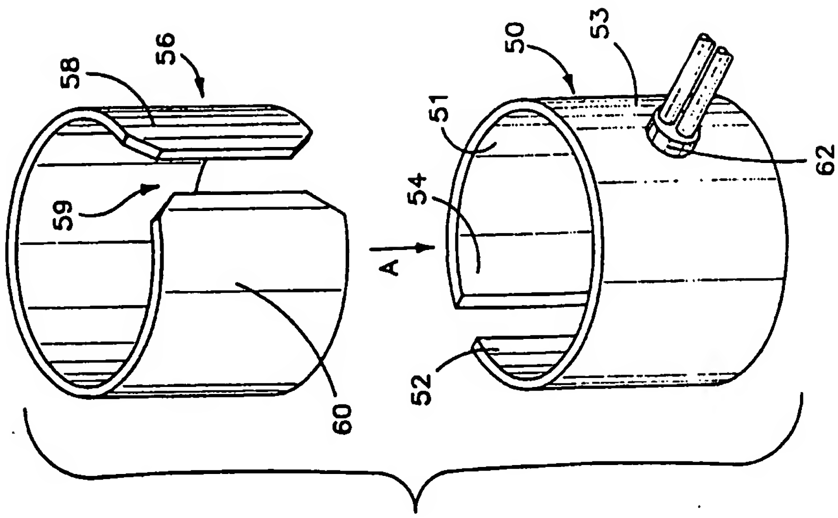
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FIG-2

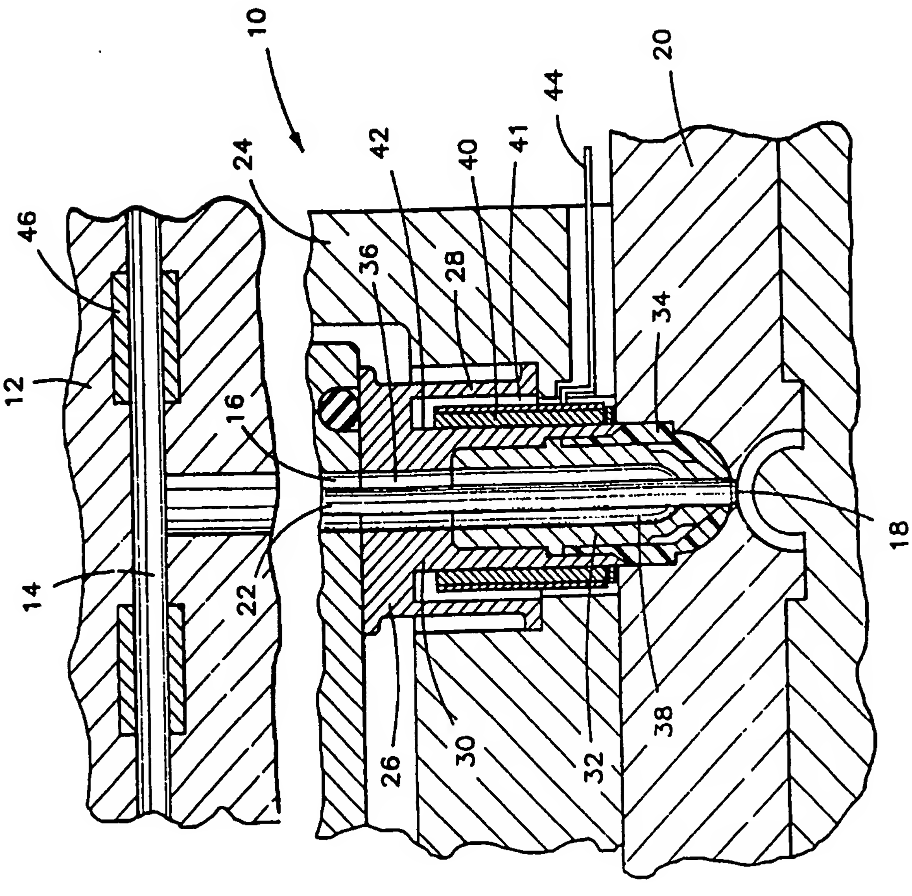
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FIG-1

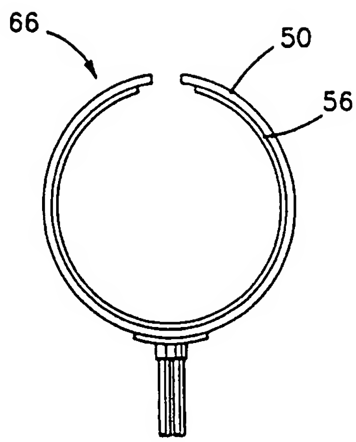


FIG-3B

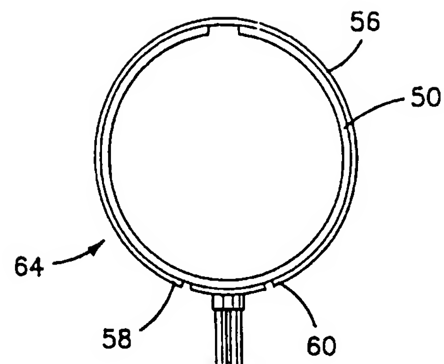


FIG-3A

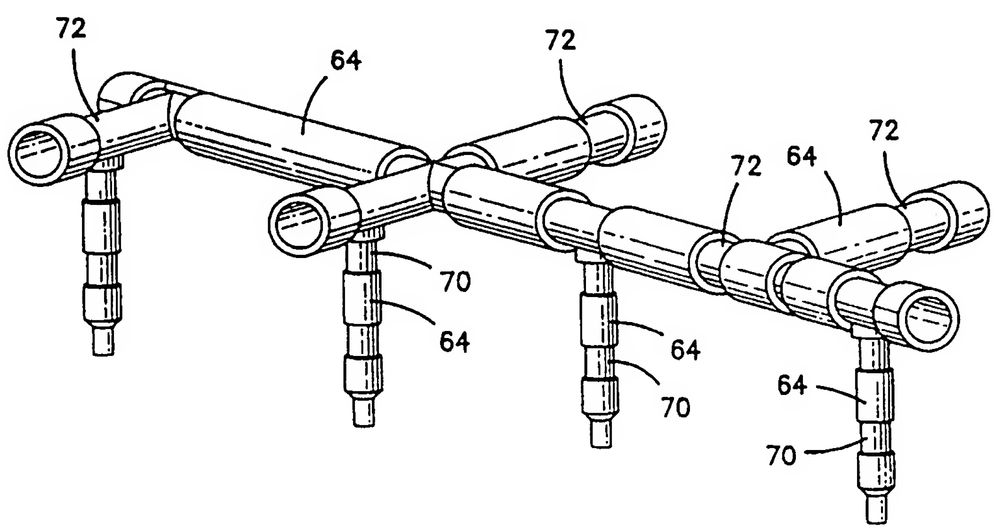
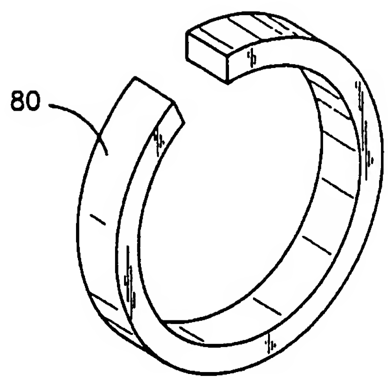
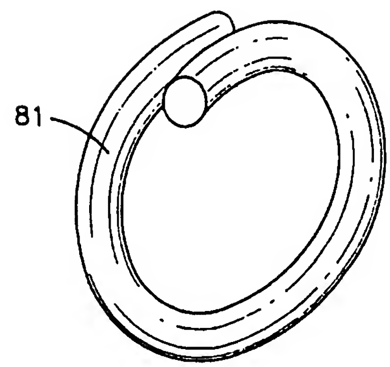


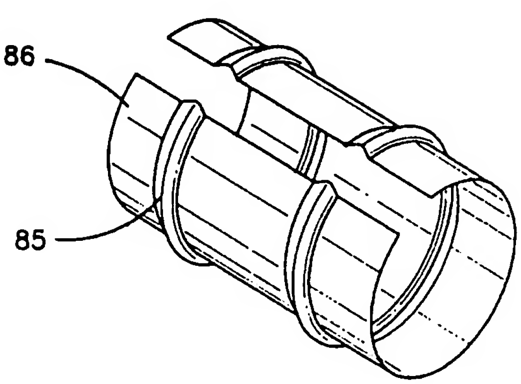
FIG-4



FIG–5A



FIG–5B



FIG–6